

Application Serial No.: 09/671,166
Amdt. dated May 6, 2003
Reply to Office Action of Jan. 6, 2003

Docket No.: N.C. 82,745
Applicant(s): Chrisey et al.

This listing of claims will replace all prior versions and listings of claims in the application:

Listing of Claims:

Claim 1 (currently amended): An apparatus for depositing a transfer material onto a receiving substrate, the apparatus comprising:

a source of pulsed laser energy with an energy density from 0.05 to 7.5 J/cm²,

a receiving substrate, and

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a target substrate comprising a laser-transparent support having a back surface and a front surface, wherein the front surface has a coating that comprises a mixture of the transfer material to be deposited and a matrix material, wherein the matrix material has the property of being or becoming more volatile than the transfer material when exposed to pulsed laser energy,

means for positioning the source of pulsed laser energy in relation to the target substrate so that pulsed laser energy can be directed through the back surface of the target substrate and through the laser-transparent support to strike the coating at a defined location with sufficient energy to cause the coating to desorb from the location and be lifted from the surface of the support,

means for positioning the receiving substrate in a spaced relation to the target substrate so that the matrix material, or decomposition products thereof, in the desorbed coating can migrate from the space between the receiving substrate and the target substrate, and so that the transfer material in the desorbed coating can be deposited at a defined location on the receiving substrate.

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Claim 2 (original): The apparatus of claim 1 wherein the transfer material is in the form of particles and wherein the coating is a colloidal or particulate suspension of the transfer material in the matrix material.

Claim 3 (original): The apparatus of claim 1 wherein the transfer material is in the form of particles having a grain size of between about 10 nm and about 20 μ m.

Claim 4 (original): The apparatus of claim 1 wherein the transfer material is a mixture of particles having different grain sizes.

Claim 5 (original): The apparatus of claim 1 wherein the transfer material is an electronic material selected from the group consisting of metals, dielectrics, ferroelectrics, ferrites, ferrimagnets, ferromagnets, phosphors, and semiconductors.
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Claim 6 (original): The apparatus of claim 1 wherein the transfer material is a polymer.

Claim 7 (original): The apparatus of claim 1 wherein the transfer material comprises metal or ceramic particles coated with organic precursors.

Claim 8 (original): The apparatus of claim 1 wherein the receiving substrate is a component of a sensing device and the transfer material is a sensing material selected from the group consisting of chemically selective material, biologically selective material, magnetic sensing material, optical sensing material, pressure sensing material, temperature sensing material, porosity selective material and gas flow sensing material.

Claim 9 (original): The apparatus of claim 1 wherein the matrix material is a material that decomposes into volatile components when exposed to pulsed laser energy.

Claim 10 (original): The apparatus of claim 9 wherein the matrix material is an addition polymer.

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Claim 11 (original): The apparatus of claim 9 wherein the matrix material is selected from the group consisting of poly(alkenes), poly(acrylics), poly(methacrylics), poly(vinyls), poly(vinylketones), poly(styrenes), poly(oxides) and polyethers.

Claim 12 (original): The apparatus of claim 9 wherein the matrix material is selected from the group consisting of polyacrylic acid -butyl ester, nitrocellulose, poly(methacrylic acid)-methyl ester (PMMA), poly(methacrylic acid)-n butyl ester (PBMA), poly(methacrylic acid)-t butyl ester (PtBMA), polytetrafluoroethylene (PTFE), polyperfluoropropylene, poly N-vinyl carbazole, poly(methyl isopropenyl ketone), poly alphamethyl styrene, polyacrylic acid, alpha phenyl-, methyl ester, polyvinylacetate, polyvinylacetate/zincbromide, poly(oxymethylene), phenol-formaldehyde positive photoresist resins and photobleachable aromatic dyes.
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Claim 13 (original): The apparatus of claim 1 wherein the matrix material is selected from the group consisting of water, aryl solvents, arene solvents, halogenated organic solvents, hydrocarbons, ketones, esters, ethers, carboxylic acids, phenols and phosphoric acid.

Claim 14 (original): The apparatus of claim 1 further including means for moving the source of pulsed laser energy and the target substrate with respect to each other so that after the coating desorbs at one location on the target substrate, the pulsed laser energy can be directed to another location on the target substrate where the coating has not yet desorbed, and

means for moving the source of pulsed laser energy and the receiving substrate with respect to each other so that the transfer material can be deposited in a pattern.

Claim 15 (original): The apparatus of claim 1 wherein the apparatus further includes a mask interposed between the source of laser energy and the target substrate.

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Claim 16 (original): The apparatus of claim 1 wherein the coating on the front surface of the target substrate has been formed by a process of combining the transfer material and the matrix material to form a mixture and applying the mixture to the front surface of the target substrate by a coating method selected from the group consisting of spin coating, ink jet deposition, jet vapor deposition, spin spray coating aerosol spray deposition, electrophoretic deposition, pulsed laser deposition, matrix assisted pulsed laser evaporation, thermal evaporation, sol gel deposition, chemical vapor deposition, sedimentation and screen printing.

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Claim 17 (original): The apparatus of claim 1 wherein the coating on the front surface of the target substrate has a thickness of between about .1 μm and about 100 μm .

Claim 18 (original): The apparatus of claim 1 wherein the coating on the front surface of the target substrate has a thickness of between about 1 μm and about 20 μm .

Claim 19 (original): The apparatus of claim 1, further including means to position the source of pulsed laser energy with respect to the receiving substrate so that the pulsed laser energy can be directed to strike the receiving substrate whereby the receiving substrate can be pretreated or whereby a transfer material deposited on the substrate can be annealed or etched.